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Who are the important sea turtle nest predators at Wreck Rock beach?

Juan Lei Corresp., [1] , **David T Booth** [1]

[1] School of Biological Sciences, The University of Queensland, Brisbane, St. Lucia, Australia

Corresponding Author: Juan Lei
Email address: lj881204@gmail.com

Excessive sea turtle nest predation is a problem for conservation management of sea turtle populations. This study assessed the predation of the endangered loggerhead sea turtle (*Caretta caretta*) nests at the Wreck Rock beach adjacent to Deepwater National Park in Southeast Queensland, Australia after a control program for feral foxes was instigated. The presence of predators on the nesting dune was evaluated by passive soil plots (2 x 1 m) every 100m along the dune front. There were 21 (2014-2015) and 41 (2015-2016) plots established along the dune and these were monitored for predator tracks daily over three consecutive months in both nesting seasons. Camera traps were also set to record the predator's activity around selected nests. The tracks of the fox (*Vulpes vulpes*) and goanna (lace monitor *Varanus varius* and/or yellow-spotted goanna *V. panoptes*; we could not distinguish these two species tracks from each other) were found on sand plots. Goannas were widely distributed along the beach and had an eight times higher Passive Activity Index (PAI) (0.31 in 2014-2015 and 0.16 in 2015-2016) compared to foxes (PAI 0.04 in 2014-2015 and 0.02 in 2015-2016). Camera trap data indicated that the appearance of yellow-spotted goannas at loggerhead turtle nests was more frequent than lace monitors and further that lace monitors only predated these nests after they had been previously opened by yellow-spotted goannas. No foxes were recorded at nests with camera traps. This study suggests that large male yellow-spotted goannas are the major predator of sea turtle nests at the Wreck Rock beach nesting aggregation.

Who are the important sea turtle nest predators at Wreck Rock beach?

Juan Lei [1] and David T. Booth[1]

[1] School of Biological Sciences, The University of Queensland, Brisbane, St. Lucia, QLD 4072, Australia.

Corresponding Author:

Juan Lei [1]

Email: lj881204@gmail.com

Abstract

Excessive sea turtle nest predation is a problem for conservation management of sea turtle populations. This study assessed the predation of the endangered loggerhead sea turtle (*Caretta caretta*) nests at the Wreck Rock beach adjacent to Deepwater National Park in Southeast Queensland, Australia after a control program for feral foxes was instigated. The presence of predators on the nesting dune was evaluated by passive soil plots (2 x 1 m) every 100m along the dune front. There were 21 (2014-2015) and 41 (2015-2016) plots established along the dune and these were monitored for predator tracks daily over three consecutive months in both nesting seasons. Camera traps were also set to record the predator's activity around selected nests. The tracks of the fox (*Vulpes vulpes*) and goanna (lace monitor *Varanus varius* and/or yellow-spotted goanna *V. panoptes;* we could not distinguish these two species tracks from each other) were found on sand plots. Goannas were widely distributed along the beach and had an eight times higher Passive Activity Index (PAI) (0.31 in 2014-2015 and 0.16 in 2015-2016) compared to foxes (PAI 0.04 in 2014-2015 and 0.02 in 2015-2016). Camera trap data indicated that the appearance of yellow-spotted goannas at loggerhead turtle nests was more frequent than lace monitors and further that lace monitors only predated these nests after they had been previously opened by yellow-spotted goannas. No foxes were recorded at nests with camera traps. This study suggests that large male yellow-spotted goannas are the major predator of sea turtle nests at the Wreck Rock beach nesting aggregation.

Key words Camera trap, Passive sand plot, Sea turtle, Nest, Predator, Predation, Yellow-spotted goanna, Lace monitor, Activity

Introduction

Sea turtles are oviparous and construct their nests on dunes adjacent to the beach where embryos take about two month to incubate without any further parental care. Sea turtle hatchling nest emergence success is determined by nest temperature, salinity, humidity, water inundation and predation (Fowler 1979; Miller 1985; Reid *et al*. 2009; Wang & Weathers 2009). During incubation a wide range of predators may attack sea turtle nests and have a significant effect on sea turtle hatchling recruitment and thus long-term population persistence (Stancyk 1995). At many beaches nest predation is the main cause of hatch failure of sea turtles with some regions reporting more than 50% of nests being destroyed by predators (e.g. Fowler 1979; Blamires & Guinea 1998; Blamires *et al*. 2003; Maulany *et al*. 2012; McLachlan *et al*. 2015). A large variety of non-human species have been reported as sea turtle nest predators including fire ants, crabs, turkey vultures, black vultures, coatis, raccoons, dogs, red foxes, golden jackals, mongoose, snakes and goannas in different regions of the world (Stancyk *et al*. 1980; Stancyk 1982; Mora & Robinson 1984; Brown & Macdonald 1995; Frick 2003; Leighton *et al*. 2008). In Australia, sea turtle nest predators include several species of native goanna (*Varanus spp*), the native dingo (*Canis familaris dingo*) and the introduced fox (*Vulpes vulpes*), pig (*Sus serofa*) and wild dog (*Canis familaris*) (Limpus 1978; Limpus & Fleay 1983).

The loggerhead turtle (*Caretta caretta*) is an endangered species on the IUCN Red List (IUCN 2003) and nests in significant numbers (~400 nests per season) at Wreck Rock beach adjacent to Deepwater National Park, Queensland, Australia, (Limpus 2008). Predators of sea turtle nests at Wreck Rock beach include foxes, dingoes and goannas (Limpus 2008). From 1987 onwards, 1080 poison baits have been used to control fox predation but a recent nest survey (McLachlan *et al*. 2015) indicated that while fox predation of nests was minimal, a large number of nests were predated by goannas. Thus, predation by goannas has become the most significant threat to the hatching success of the loggerhead turtle nests at Wreck Rock beach. The lace monitor (*Varanus varius*) and yellow-spotted goanna (*Varanus panoptes*) are likely to be the main goannas attacking loggerhead nests because of their distribution along the coastline and ability to dig holes while foraging (Cogger 1993).

For some animal species, it is difficult to estimate population density by standard census methods such a mark and recapture (Engeman & Allen 2000) because of large home ranges, rough terrain habitats, relatively sparse populations and/or difficulty in capturing animals or making direct observations (Pelton and Marcum 1977). To overcome these problems, Engeman & Allen (2000) developed and refined a passive activity index (PAI) for monitoring wild carnivorous species, which is simple and quickly applied in the field, and can also provide accurate information reflecting population changes over time or space. Engeman & Allen (2000) argued that it is unnecessary to know the precise population density of predators when formulating predator control measures, all that is needed is a reliable index that tracks predator

activity and how this activity changes with instigation of management strategies. This method has been used previously to monitor predator activities, including the common water monitor (*Varanus salvator*) activity on an olive ridley turtle (*Lepidochelys olivacea*) nesting beach in Alas Purwo National Park, Banyuwangi (East Java), Indonesia over two nesting seasons (Maulany 2012).

The aim of the current study was to quantify goanna activity on nesting dunes during the sea turtle nesting season at Wreck Rock beach and to see how this activity related to sea turtle nest predation. In addition, camera traps were used to monitor goanna activity at sea turtle nests in order to identify which goanna species is the main predator of these nests.

Methods

Study site and nest monitoring

This study was conducted along the beach for 2 km immediately to the north and south of Wreck Rock adjacent to Deepwater National Park, Southeast Queensland (24°18' 58 S, 151°57' 55" E) (Fig. 1). This section of the beach is marked by numbered stakes every 100 m for ease of marking and relocating nests. The beach was monitored nightly by personnel from Turtle Care Volunteers Queensland Inc. to record the presence of emerging female turtles and successful nesting activities. All work was approved by a University of Queensland Animal Ethics Committee (permit #SBS/352/EHP/URG) and conducted under Queensland Government National parks scientific permit # WITK15315614. When a nest was located, its position was

marked by a red ribbon attached to a small stake and recorded using a handheld GPS (Garmin eTrex 30, Kansas, USA).

Once a nest was located it was visited daily throughout the incubation period in order to identify predation events and the tracks of animals visiting nests. Nest visitation rate was quantified as a percentage by dividing the number of days fresh tracks were found at a nest by the total number of nest inspection days (nest inspection days = total number of times a nest was inspected during the season until hatchlings emerged from the nest or until it was totally predated) multiplied by 100.

Camera traps

Camera traps (Reconyx Hyperfire HC600, Holmen, Wisconsin, USA) were set up to capture images of predators visiting a sample of 12 loggerhead turtle nests between 6 December 2014 and 27 January 2015, and 30 nests between 1 December 2015 and 27 February 2016. Camera traps were at each nest for 25 days in the 2014-2015 and 30 days in the 2015-2016 nesting season. This enabled information on the frequency, time of day and species to be collected. To compare the relative activity of goannas visiting nests each year with PAI and nest predation rates between years, we calculated the number of camera trap days each season (= sum of total number of days each nest was monitored in a season for all nests monitored in a season). Nest visitation rate (%) for camera trap monitored nests was defined as the 100 times the number of independent photographs of goannas recorded at nests divided by the number of

camera trap days.

Passive soil plots

Passive soil plots were used to estimate a predator species' relative activity during the peak sea turtle nesting time (December – March) across two consecutive years. In the 2015-2016 these plots were also monitored for four days in April, a time when most sea turtle clutches had finished incubating and hatched. Twenty-one sand plots (2 m x 1 m) in the first nesting season (2014-2015) and 41 in the second nesting season (2015-2016) spaced 100 m apart were set up on the primary dune (where most sea turtle nests were constructed). The plots covered the dunes for 1 km (2014-2015) and 2 km (2015-2016) north and south of Wreck Rock camping area and their locations were marked by sticks placed at each corner of the plot and the plot location recorded with a handheld GPS. Each plot was inspected during the afternoon (weather permitting) and the number of tracks and species of each track were recorded. After reading, plots were resurfaced using a rake to obliterate tracks insuring the same tracks were not recorded on subsequent days. The activity of predators was quantified as a passive activity index (PAI) according to the method of (Engeman *et al*. 1998):

$$PAI = \frac{1}{d}\sum_{j=1}^{d}\frac{1}{Pj}\sum_{i=1}^{Pj}Xij$$

where the *Xij* value represents the number of passive plot tracks by an observed species at the *i*th plot on the *j*th day; *d* is the number of days of inspection, and *Pj* is the number of plots contributing data on the *j*th day. PAI was calculated for weekly intervals throughout the study.

Results

148 Nest monitoring

149 During the first sea turtle nesting season (5/12/2014 until 4/3/2015), 52 loggerhead turtle nests
150 were monitored and 57.7% of these nests were predated by goannas as indicated by burrows
151 constructed into the nest egg chamber. During the second nesting season (7/12/2015 until
152 28/2/2015), 46 nests were monitored and 17.4% of these nests were predated by goannas. No
153 fox or other predators were observed to raid turtle nest in either season. During the 2014-2015
154 nesting season, 520 goanna nest visits as evidenced by their tacks were recorded, with a daily
155 visitation rate of 26.8%. Three hundred and forty-three nest visitation events were recorded in
156 the 2014-2015 nesting season, with a daily visitation rate of 14.1%. No tracks of foxes or wild
157 dogs were recorded on the nests in either nesting seasons.

158

159 Camera traps

160 Images from camera traps showed that goannas were the only predators to visit monitored
161 nests during the study period, no images of foxes or wild dogs were recorded. All of the
162 monitored nests had at least one image of a goanna visit during the deployment period, with 55
163 nest visitation events being recorded in the 2014-2015 nesting season, and an overall daily
164 camera trap visitation rate of 18.3%. Forty-seven (85.5%) of these visitation events were made
165 by yellow-spotted goannas (*Varanus panoptes*) and only 8 (14.5%) were made by lace monitors
166 (*Varanus varius*). Despite all camera traps being deployed by 20 December 2014, only two
167 goannas appeared at nests in December 2014, but activity at nests increased sharply from the
168 beginning of January 2015 (Fig. 2a). Eggs were seen to be consumed on 17 occasions (14

yellow-spotted goannas, 3 lace monitors). Yellow-spotted goannas were seen to open a nest for the first time on 17 occasions, but lace monitors were only ever seen to visit nests that had already been opened. In the 2015-2016 nesting season, no images of foxes or wild dogs were recorded. One hundred and seven goanna nest visiting events were captured, with a daily camera trap visitation rate of 11.9%. Camera traps captured 87 yellow-spotted goanna (81.3%) and 20 lace monitor (18.7%) events (Fig. 2b). Eggs were seen to be predated by yellow-spotted goanna on 6 occasions. No lace monitor was seen to consume eggs during this season. In both seasons, large adult yellow-spotted goannas were seen to open turtle nests, but no images of yellow-spotted goanna hatchling or sub-adults visiting turtle nests were recorded. Hence, adult yellow-spotted goannas were the most common visitors to sea turtle nests in both seasons. The visitation events of each monitored nest are listed in Table 1.

Goannas visited nests at any time of the day between 8:00 and 18:00 (Fig. 2). An entire nest opening sequence was recorded on 23-01-2015. A large yellow-spotted goanna first began digging at 2:12 pm (Fig 3a). It reached the egg chamber and consumed the first egg at 2:28 pm after 16 minutes of continuous digging activity (Fig 3b). Turtle eggs were swallowed intact one at a time by the goanna rather than being opened and having their contents licked out (Fig 3c). This goanna stopped feeding and left the nest at 4:56 pm after almost 2.5 hours of feeding and consuming approximately eight eggs.

Passive soil plots

Monitored soil plots revealed tracks of two potential egg predators, goannas (lace monitors and yellow-spotted goannas combined as it was not possible to distinguish between the two species on the basis of their tracks alone) and red fox (*Vulpes vulpes*). Only a few dog tracks were identified in soil plots during the course of the study. However, these dog tracks were most likely made by pet dogs accompanying tourists visiting the beach, and so have been excluded from analysis.

In both the 2014 - 2015 and 2015 - 2016 nesting seasons goanna activity was approximately eight times greater than fox activity (2014-2015 goanna PAI 0.31 ± 0.03 (mean ± SE), fox PAI 0.04 ± 0.01; 2015-2016 goanna PAI 0.16 ± 0.01, fox 0.02 ± 0.01). During the 2014-2015 season, goanna activity on the dune front remained relatively constant throughout the season (Fig. 4). Fox activity was generally much lower than goanna activity from December through January, but there was a conspicuous increase in fox activity in February (Fig. 4). In the 2015-2016 nesting season, goanna activity was relatively low in December, increased during January and February and decreased again at the end of February and was lowest in April at a time when most sea turtle nests had hatched. Fox activity remained low and relatively constant throughout the entire season (Fig. 4). Goanna activity was twice as great during the 2014-2015 sea turtle nesting season compared to the 2015-2016 season (Fig.4).

Discussion

Nest predation potentially decreases the recruitment of hatchlings and has become an

211 important challenge for the conservation of egg-laying reptiles (Leighton *et al*. 2010). Hence,
212 understanding the activity of predators adjacent to endangered reptilian species breeding
213 aggregations is important for designing conservation strategies. The deployment of passive
214 sand plot and camera traps allowed us to continuously monitor nest predators activities
215 adjacent to a loggerhead turtle nesting beach. There were two significant results from the study
216 that provide new insights into goanna predation of sea turtle nests. First, camera trap data
217 indicated that yellow-spotted goannas are the most frequent visitors and predators of sea
218 turtle nests at Wreck Rock beach suggesting they are the main cause of nest predation. Second,
219 the nest predation rate and activity of goannas on the nesting dune varied by a factor of two
220 between the two seasons that we studied.
221
222 Predator activities at nests
223 In the current study, camera traps allowed us to explore the loggerhead turtle nest predator
224 species, predation time and behavior of predators while at nests. Yellow-spotted goannas were
225 the most frequent visitors and predators of sea turtle nests in this study. Large adult yellow-
226 spotted goannas have the ability to dig up sea turtle nests and swallow turtle eggs intact,
227 suggesting future management strategies should be targeted at these individuals. Indeed, no
228 lace monitors were observed to open sea turtle nests directly, they were only observed
229 predating nests that had already been opened by yellow–spotted goannas. Hence, lace
230 monitors appear to be opportunistic nest predators on this beach. Lace monitors are frequently
231 arboreal and are equipped with long, recurved claws that facilitate climbing (Cogger 1993).

Such claws are not particularly useful for digging, therefore this species may not have the ability to dig up sea turtle nests. Anecdotal observations made while regularly walking the beach also suggest that lace monitors use the beach area less frequently than yellow-spotted goannas, because yellow-spotted goannas were regularly seen on or adjacent to beach dunes, but lace monitors were rarely seen. Using GPS tracking methodology, Lei & Booth (2015) reported yellow-spotted goannas use the beach more than lace monitors and are therefore more likely to predate sea turtle nests than lace monitors. Hence, it appears that yellow-spotted goannas, in particular the large male individuals that open up nests, make the nest available for predation by opportunistic lace monitors. Moreover, camera traps did not record foxes at nests, and no fox tracks were observed over nests during this study indicating that the fox baiting program deployed by park managers is currently effective at inhibiting fox predation of sea turtle nests at Wreck Rock beach.

Doody *et al*. (2014, 2015) reported that yellow-spotted goannas can dig warren complexes that required removal of sand from up to 3 m deep, and that both males and females contribute to warren excavation. Hence, the job of digging into a sea turtle nest which is combatively shallow (40 - 80 cm), should be relatively easy as evidenced by it requiring only 16 minutes of digging to gain access to eggs in one of our monitored nests. Our camera trap photos indicated yellow-spotted goannas normally dug into the nest at an angle from one side of the nest to reach the nest chamber rather than digging a hole vertically downwards from directly above the nest. This is probably an instinctive way to dig, because burrow construction by this species in the

253 area well behind the dunes are always at an oblique angle to the surface and never vertical
254 (pres. obs.). This digging behaviour may save on the amount of sand needed to be removed in
255 order to access eggs in newly constructed nests because the relatively loose sand covering a
256 newly constructed nest tends to collapse inward during vertical shaft construction. Hence,
257 when covering a nest with mesh as a management strategy used to deter nest predation, the
258 mesh must be relatively large in area (at least 1 x 1 m) to prevent yellow-spotted goanna
259 burrowing into the nest (Lei & Booth 2017 Unpublished data). Turtle nest predation rate is
260 highly dependent on cues left by the female turtle (e.g. visual, tactile, and olfactory) and many
261 predators have the ability to detect these cues (Vander Wall 1998, 2000; Geluso 2005; Leighton
262 *et al*. 2009). Goannas use their forked tongue to transfer olfactory cues to the specialised
263 chemosensory Jacobson's organ and so are adept at using olfactory cues to find prey (Blamires
264 & Guinea 1998; King & Green 1999; Vincent & Wilson 1999). In addition, goannas are skilled at
265 memorizing prey cues and searching images of prey which enhance their foraging strategies
266 (King & Green 1999). We found that once a turtle nest was opened, this nest was continually
267 predated over subsequent days by multiple yellow-spotted goannas.
268
269 Predator activity
270 Based on the PAI analysis of passive soil plot data, the activity of goannas was higher than foxes,
271 suggesting goannas are the main predator of sea turtle nests at Wreck Rock beach, a conclusion
272 also supported by nest track and camera trap data. We found that all of our monitored nests
273 were visited by goannas, and that between 17% (2015 - 2016) and 58 % (2014- 2015) of nests

were opened by yellow-spotted goannas, and goanna predation of nests had previously been reported as greater than 50% at this beach (McLachlan *et al*. 2015). The question remains if goanna predation of sea turtle nests was this high at Wreck Rock beach during pre-European settlement times, or if perturbations have occurred leading to unnaturally high nest predation in relatively recent times. During the 1970's, 1980's and 1990's goanna predation of sea turtle nests at this location was not detected, but fox predation of nests was high, 90% of nests being predated in the 1970's and up until 1987 (Limpus 2008). From 1987 onwards, a fox baiting program reduced fox predation on sea turtle nests to negligible levels (Limpus 2008). Goanna predation of sea turtle nests was first reported in the 2003-2004 nesting season when two nests were predated (Limpus 2008), and since then goanna predation of sea turtle nests has increased so that over 50% of sea turtle nests are being attacked by goannas (McLachlan *et al*. 2015). Hence, the reduction in red fox numbers may have also resulted in an increased recruitment of yellow-spotted goannas (because red foxes probably also predated yellow-spotted goanna nests) to historically high levels. However, before European settlement and the introduction of foxes, hunting of goannas by native people may have kept the density of goannas on the frontal dunes at a low level.

Goanna activity in 2014-2015 was twice as high compared to the 2015-2016 nesting season, as was the nest predation rate. This suggests that nest predation is positively correlated with goanna activity. The fact that Maulany (2012) reported olive ridley turtle nests suffered a 100% predation rate in a high goanna activity beach (PAI of 1.27 in 2009 and 1.41 in 2010) adjacent to

Alas Purwo National Park, Banyuwangi (East Java), Indonesia suggests that goanna activity on dunes is a good predictor of intensity of goanna predation on sea turtle nests

Fox activity increased at the end of the 2014-2015 nesting season. Typically the park mangers fox bait twice during the sea turtle nesting season, once in early December and again in early February. In 2014-2015 the February baiting was missed so any new foxes that might have moved into the beach area may not have been removed by baits, and thus fox activity increased. However, in the 2015-2016 season, the early February fox baiting proceeded and this might have kept fox activity to low levels.

The predation rate in 2014-2015 was three times higher than in 2015-2016 and it correlated with an increase in goanna activity on the dune. The nest visitation rate by recording tracks in 2014-2015 was nearly twice that in 2015-2016. In addition, nest visitation rate from camera traps in 2014-2015 (18.3%) was higher than 2015-2016 (11.8%) nesting season. These results suggested goanna activity on the dune in 2014-2015 was higher than in 2015-2016. However, he observed no obvious reason why goanna dune activity and sea turtle nest predation rate varied remarkably between the two monitored sea turtle nesting seasons.

Implications for management

Lei & Booth (2017 Unpublished data) compared different methods of directly protecting sea turtle nests against goanna predation, and found deploying the plastic mesh on the top of turtle nest was the most effective and economic way. Combined with our observations of digging

behaviour of yellow-spotted goanna captured on camera traps, we suggested the size of plastic mesh needs to be at least 1 x 1m to prevent yellow-spotted goannas digging into the nest chamber. In addition, camera trap data indicated turtle nest predation activities happen any time between 6:00 and 17:00, suggesting turtle nest management should be deployed in the early morning following the night that nests are constructed. More management strategies such as temporary removal of large male yellow-spotted goannas or egg relocation should be investigated in the future to counter act the loss of sea turtle nests to yellow-spotted goanna predation.

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Table 1(on next page)

Table of sea turtle nest visitation events

Table 1. The nest visitation events of each monitored nest during 2014-2015 and 2015-2016 nesting seasons.

Table 1. The nest visitation events of each monitored nest during 2014-2015 and 2015-2016 nesting seasons

Nest no.	Monitored days	Visitation events by yellow-spotted goanna	Visitation events by lace monitor
2014-2015			
K77290	25	1	0
QA45120	25	23	4
QA45007	25	4	2
K90312	25	3	0
K77224	25	1	1
QA2361	25	1	1
K34755	25	4	0
T22728	25	1	0
QA45046	25	1	0
K67674	25	2	0
QA45041	25	5	0
K97736	25	1	0
2015-2016			
K17005	30	1	0
K19816	30	14	3
K22153	30	0	1
K22233	30	2	0
K22264	30	1	0
K67576	30	3	2
K71417	30	14	2
K77273	30	1	1
K91832	30	2	0
QA10173	30	3	0
QA2303	30	1	0
QA2308	30	5	0
QA2310	30	4	0
QA2349	30	3	1
QA2356	30	1	0
QA27794	30	1	0
QA30893	30	0	1
QA4159	30	2	0
QA45138	30	1	1
QA45152	30	1	0
QA45154	30	2	0
QA45166	30	2	0
QA45172	30	1	1
QA45178	30	6	0

QA45191	30	1	1
QA45197	30	5	0
QA50213	30	1	0
QA50215	30	1	2
QA50248	30	6	2
QA50257	30	4	0

Figure 1(on next page)

Image of study area

Figure 1. Location of study site, Wreck Rock beach adjacent to Deepwater National Park, Queensland, Australia. Shaded grey area indicates the section of beach monitored in this study. The locations of the loggerhead turtle nests monitored in the study are indicated by diamonds (2014-2015) and triangles (2015-2016).

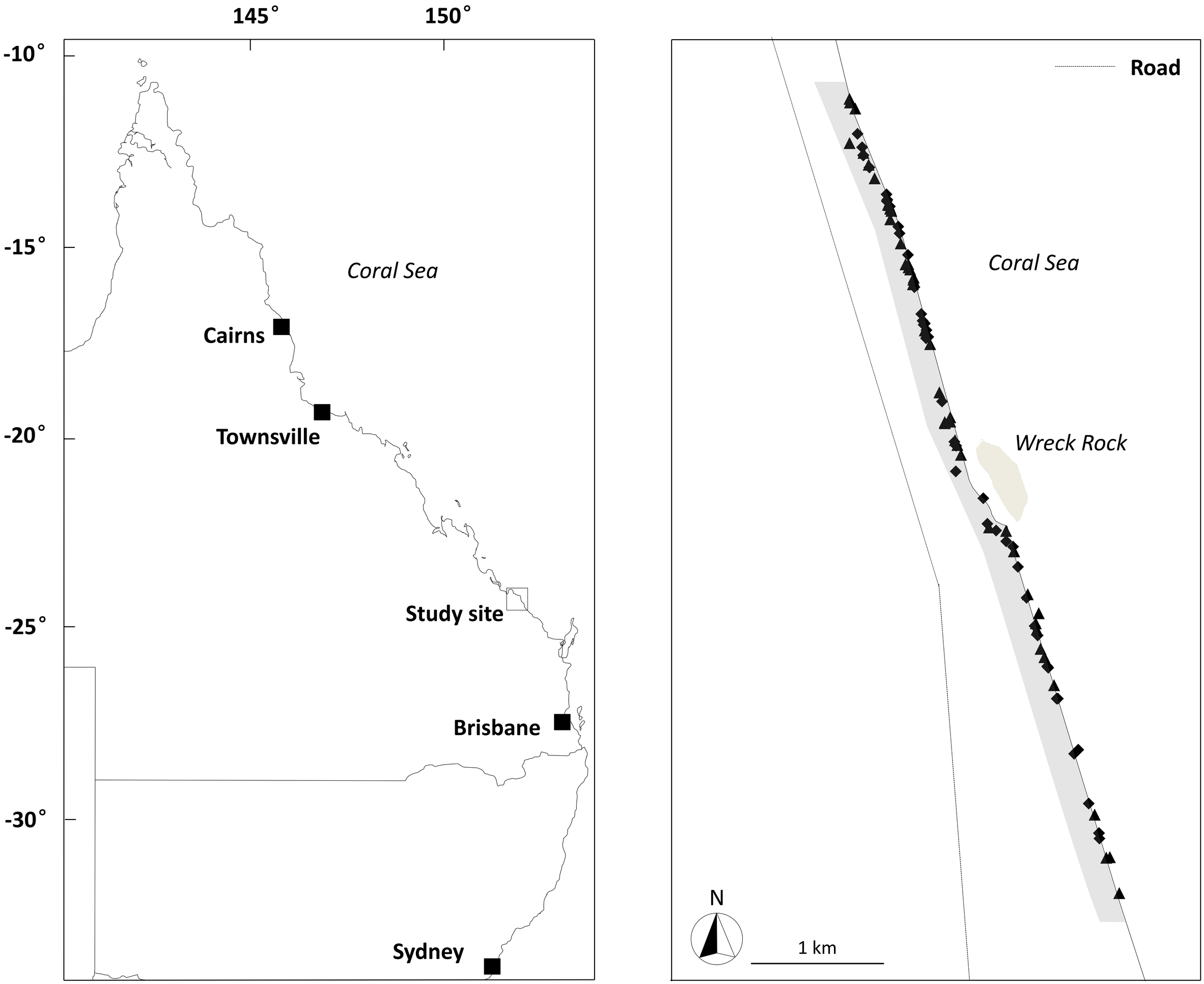

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Figure 2(on next page)

Figure of timeand date of goanna appearances at loggerhead turtle nests as determined fromcamera trap records

Figure 2. Time and date of goanna appearances at loggerhead turtle nests as determined from camera trap records. Triangle symbols = yellow-spotted goannas, Diamond symbols = lace monitors. A. Three hundred camera days (12 cameras set for 25 days each) during the 2014-2015 season. B. Nine hundred camera days (30 cameras set for 30 days each) during the 2015-2016 season.

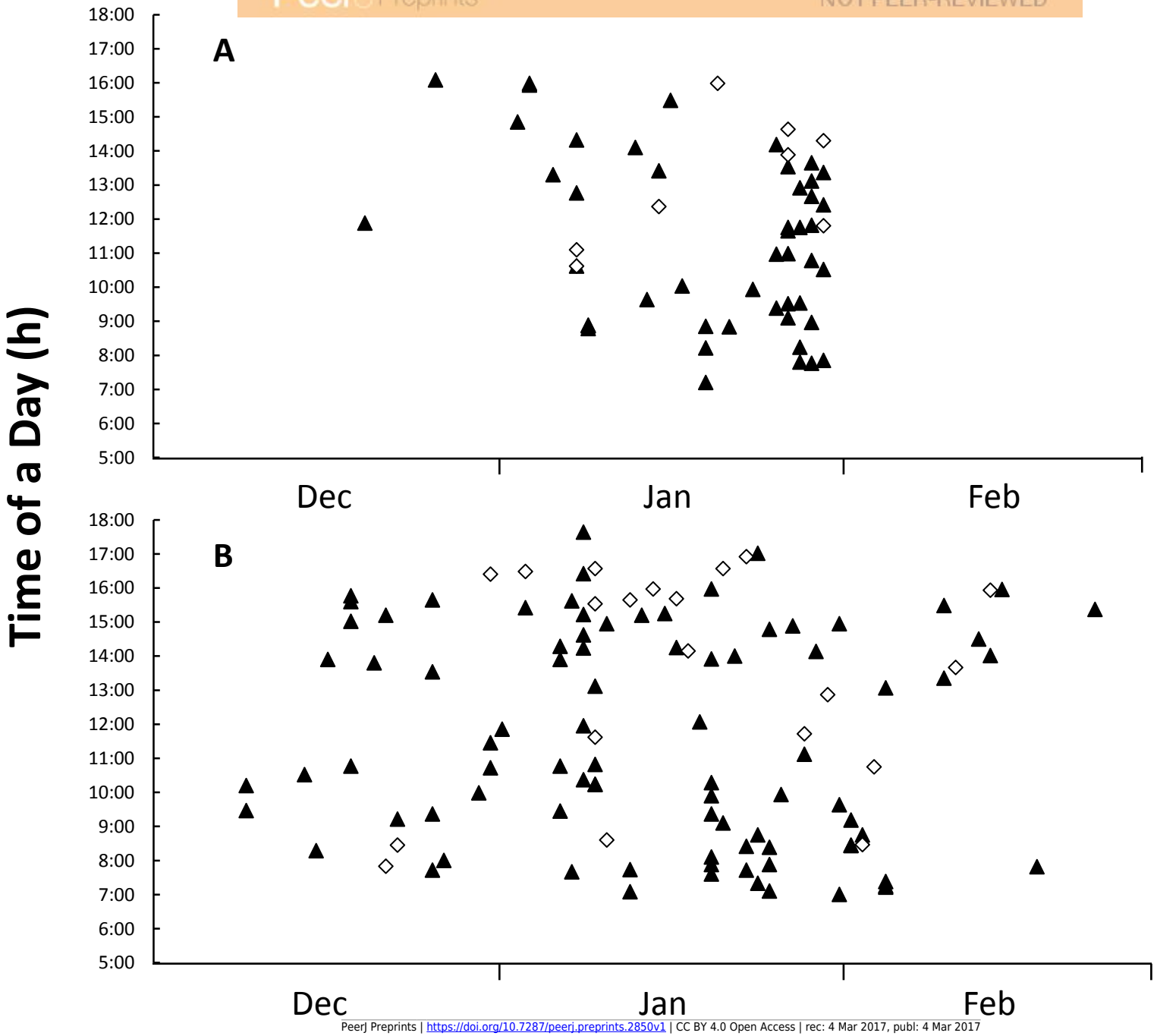

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Figure 3

Image of a yellow-spotted goanna predating on a nest

Figure 3. A Yellow-spotted goanna opening and consuming eggs from a loggerhead turtle nest on 23-01-2015. Photos were captured by a camera trap. A. Start of digging, B & C, removal and consumption of the first egg. For full sequence, see video in the supplementary information section on line.

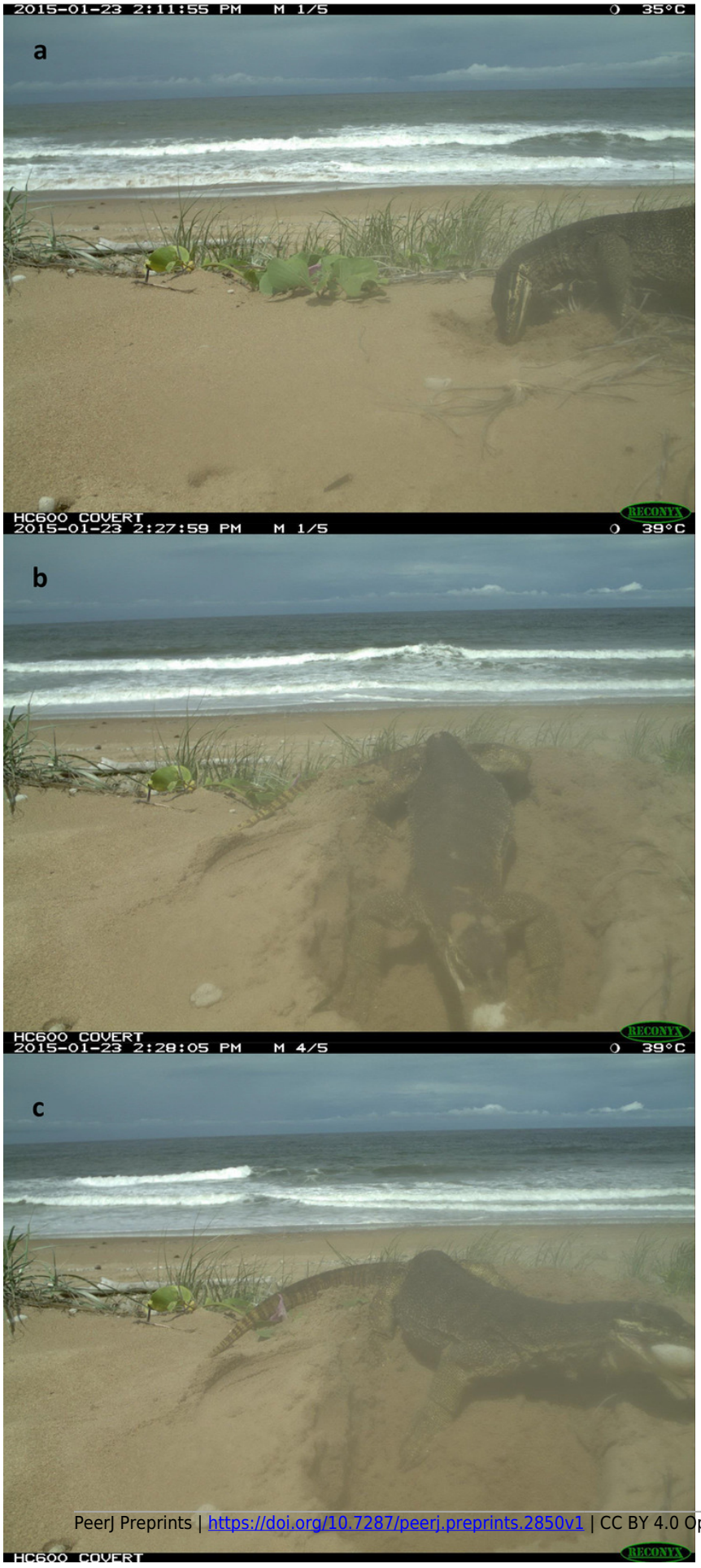
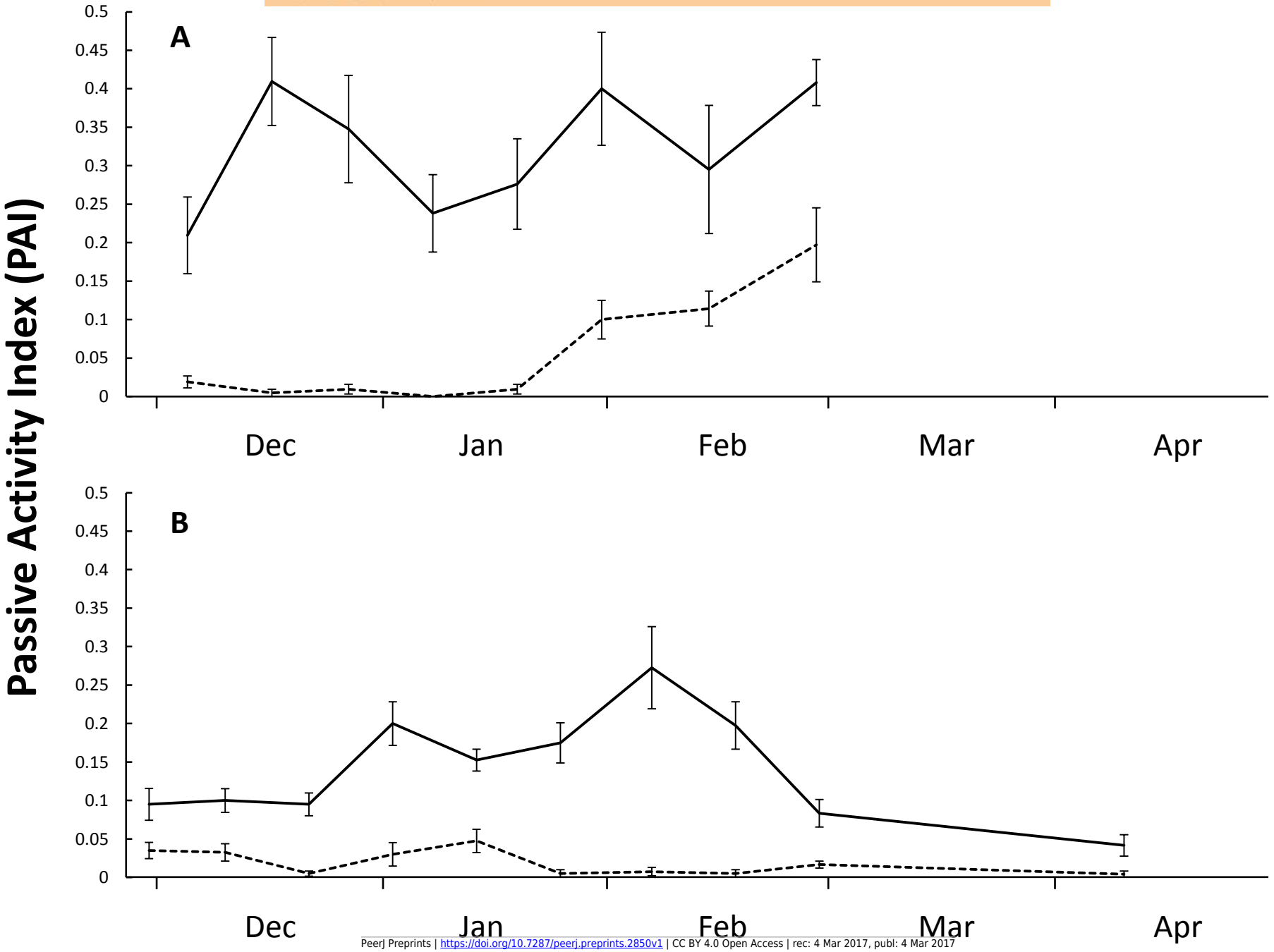


Figure 4(on next page)

A figure of predators' activity on the turtle nesting beach

Figure 4. Nest predator track activity on front dune at Wreck Rock Beach during the 2014-2015 and 2015-2016 nesting season. Solid line= Goanna tracks; Dotted line= Fox tracks.



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